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Ensemble Phase Averaged Equations for Multiphase Flows in Porous Media DUAN ZHANG, Los Alamos National Laboratory — Many multiphase flows in porous media are modeled by application of Darcy's law to each phase separately. Sometimes, often in a fluid imbibition process, the flow is modeled as a diffusion process. Both models have been found applicable in some cases, but insufficient for others. In the present work, using the ensemble phase averaging technique for continuous multiphase flows, averaged momentum equations for multiphase flows in porous solids are studied. Under the assumption that the typical dimension of fluid interfaces is small compared to the macroscopic length scale, the averaged momentum equations for fluids are found to be in a form similar to Darcy's law, but with additional terms representing the effect of phase interactions on fluid interfaces. In a simple example of two fluids in a porous solid, we find that the difference in the average pressures of the two fluids is not necessary related to the surface tension effect. If the pressure difference, or the capillary pressure, is decomposed into a static part, representing the surface tension effect, and a dynamic part, then the dynamic part of the capillary pressure appears as terms in the averaged momentum equations. We also study conditions under which a fluid imbibition process can be modeled as a diffusion process.

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